

THE OFFICE ACTION

In the Office Action issued on July 28, 2004, the Examiner rejected claim 15 under 35 U.S.C. §112, second paragraph, as being indefinite for insufficient antecedent basis for the claimed limitation. The Examiner rejected claims 1-9 under 35 U.S.C. §103(a) as being unpatentable over the article *Quantum Pillar Structures on n+ Gallium Arsenide Fabricated Using "Natural" Lithography*, Green et al., Appl. Phys. Lett. 62, January 1993 ("Green") in view of the article *Nanostructure Array Fabrication With a Size-controllable Natural Lithography*, Haginoya et al., Appl. Phys. Lett. 71, November 1997 ("Haginoya"). Further, claims 11-13 and 17-20 were rejected under 35 U.S.C. §103(a) as being unpatentable over Green in view of Haginoya and further in view of U.S. Patent No. 6,153,010 to Kiyoku et al. ("Kiyoku").

REMARKS

Applicant has carefully considered the Office Action issued on July 28, 2004. Applicant respectfully requests reconsideration of the application in light of the above amendments and the following comments.

A. The Examiner's §112 Rejection Has Been Addressed

The Examiner rejected claim 15 under 35 U.S.C. §112, second paragraph. Specifically, the Examiner objected to the use of the term "the combination of materials" as not having sufficient antecedent basis. An amendment has been made to claim 15 addressing this rejection. Withdrawal of this rejection is therefore requested.

B. The Pending Claims Are Patentable Over Green in View of Haginoya

The Examiner rejected claims 1-9 under 35 U.S.C. §103(a) as being unpatentable over Green in view of Haginoya. Applicant respectfully traverses.

Haginoya is directed to a technique for fabricating an arrayed nanostructure using self-assembly of polystyrene beads in which the array pitch is determined by the size of polystyrene nanospheres, and the size of the formed nanostructure can be arbitrarily selected by adjusting the dry etching time of the beads. Polystyrene beads are first deposited on a silicon substrate. The polystyrene beads are then thinned by reactive ion etching with oxygen. Pt-Pd is then deposited on top of the polystyrene coated substrate. The beads (and the Pt-Pd covering the beads) are then removed. The sample is then etched again by RIE, which due to the higher etching resistance of

Pt-Pd (compared to Si), creates a nano-hole array.

Conversely, Green is directed to a natural lithography process in which CsCl islands deposited on a substrate act as a resist during a subsequent etching step. This results in an etching away of the substrate in those areas not coated by the CsCl, forming pillar structures. A proposed combination of Haginoya and Green fails to suggest the present invention for at least the following reasons.

First, there is no motivation to combine Green with Haginoya. To properly combine references under §103, there must be some suggestion to combine the prior art references and a reasonable expectation of success. *Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 56 USPQ2d 1456 (Fed. Cir. 2000). In making this determination, "the claimed invention must be considered as a whole, multiple cited prior art references must suggest the desirability of being combined, and the references must be viewed without the benefit of hindsight afforded by the disclosure." *In re Paulsen*, 31 USPQ2d 1671 (Fed. Cir. 1994). In this respect, prior art references must be considered in their entirety, including portions that would lead away from the claimed invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 220 USPQ 303 (Fed. Cir. 1985). Here, there is no motivation to combine the teachings of the references. In fact, the references actually teach away from such a combination.

Specifically, it is clear from the left hand column of page 2934 of Haginoya that it suggests an alternative to natural lithography (such as disclosed in Green), rather than a modification of it as the Examiner contends. In other words, instead of producing islands by means of natural lithography, Haginoya discloses a process in which features are covered with a resist material and subsequently removing the covered features. In Haginoya, holes are formed in the Si substrate at points where the polystyrene beads were removed. In Green, on the other hand, the substrate is etched in places where the CsCl is NOT deposited. The processes are completely different. One advantage of natural lithography is that it is not necessary to provide an additional physical mask, as the islands are formed by the natural lithography process itself.

The alleged improvement of Haginoya is a technique which uses a close packing of polystyrene beads to define the feature spacing (the pitch) and the step of controlled etching of the beads to control the size of each feature. Thus, the improvement does not lie in the application of a metal layer as a resist, but in a different technique for forming the features. When considering Haginoya, a person skilled in the art would actually be led away from the teachings of Green and the presently claimed invention, because the technique of forming features by natural island lithography as disclosed in

Green is portrayed as inferior by Haginoya (see last sentence of first paragraph of Haginoya). Green and Haginoya effectively teach two distinct and incompatible technologies and the Examiner's position that it would have been obvious to combine Haginoya and Green because Haginoya would improve natural lithography by providing the ability to control the nanostructure size is simply incorrect. Applicants are at a loss as to what type of combination of Haginoya and Green the Examiner is contemplating. Combining the teachings of the two references would not even be considered by one skilled in the art due to the inherent incompatibility of the two references.

Here the Examiner has clearly found references allegedly disclosing the elements of the present invention, and proposed a combination based on these references even though they relate to completely disparate subject matter, provide no suggestion for such a combination, and indeed could most likely not be combined. This is a classic example of impermissible hindsight reconstruction. A recognition that something can be done is distinct from a motivation to do it. Absent such a suggestion or motivation, the Examiner's combining of the two references is a classic example of impermissible hindsight reconstruction. *Texas Instruments, Inc. v. U.S. Int'l Trade Comm'n*, 26 USPQ2d 1018 (Fed. Cir. 1993).

Using the technique of Haginoya, once the resist material has been deposited on the substrate and the array of spheres, the result is a discontinuous layer of resist material whereby there is no (or at least no substantial) continuous connection of resist material deposited on the substrate surface and on top of the spheres, as seen in Fig. 1 of Haginoya. This allows the spheres to be simply wiped away in order to reveal an array of holes.

There is no indication in Haginoya that this technique of removing the covered polystyrene spherical beads would work with the hemispherical features disclosed in Green and recited in the present claims. In fact, using the hemispherical features of the claimed invention requires a special lift off process in order to detach the hemispheres which are covered by a continuous resist layer along with the substrate. It is not obvious that the coated hemispheres of the present invention would lend themselves to a "lift-off" process such as disclosed in Haginoya and indeed, if the metal film is too thick it will not be possible. Because the skilled person would see that the process described by Haginoya would not work when hemispherical features are used, one would not be motivated to combine the teachings of the two references.

Further, and with regard to claim 21, the fact that the use of hemispherical features results in a continuous film of resist material requires that a lift off process (for

example ultrasonic agitation) is used which pierces the film covering the hemispheres. This results in a constraint on the thickness of the film of resist material with respect to the diameter of the island. There is no mention in the cited prior art of this constraint, let alone the specific claimed value.

For at least these reasons, applicants submit that the proposed combination of Barberi and Pirs is inappropriate and fails to render the present claims unpatentable.

C. The Pending Claims Are Patentable Over Green in View of Haginoya and Further in View of Kiyoku

The Examiner rejected claims 11-13 and 17-20 under 35 U.S.C. §103(a) as being unpatentable over Green in view of Haginoya and further in view of Kiyoku. Applicants respectfully traverse.

First, there is no motivation to combine the teachings of Haginoya with Green, as described above. Thus, there is no motivation to combine the cited references. In addition, Applicants cannot see how Kiyoku is at all relevant to the present invention. The Examiner acknowledges in the office action that "unlike the claimed invention, Kiyoku does not describe the pattern is formed using the method of claim 1". In fact, the only thing that Kiyoku appears to have in common with claim 1 is that it results in the formation of the pattern of semiconductor which the Examiner chooses to call "islands". Of course, almost all semiconductor fabrication involves the production of individual areas which could be regarded as "islands", but involve various and unrelated process steps. The Examiner's rejection based on a combination of this reference is not relevant to the present technology or that cited in the other references. For at least these reasons, the proposed combination fails to render the present claims obvious.

D. Support Exists for the Proposed New Claims

Support can be found for new claims 21-24 as follows. Support for the recitation that the film thickness is less than a fifth of the average diameter of the islands can be found on page 7, lines 5-6. Support for the recitation that the resist material is deposited at a grazing angle as well as support for the recitation of a vapor shadow and wells having elliptical cross-sections can be found on page 3, lines 10-18 and page 7, lines 1-4.

In addition, since the new claims contain all of the limitations of claim 1, they are

patentable over the cited art for at least the reasons discussed above with respect to claim 1. They are patentable for the additional reasons that the cited art and any proposed combination thereof fails to disclose or suggest the claimed film thickness to island diameter ratio of claim 21 or the deposition of the resist material at a grazing angle as recited in claim 22.

CONCLUSION

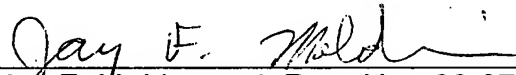
In view of the foregoing comments, Applicants submit that claims 1-24 are in condition for allowance. Applicants respectfully request early notification of such allowance. Should any issues remain unresolved, the Examiner is encouraged to contact the undersigned to attempt to resolve any such issues.

If any fee is due in conjunction with the filing of this response, Applicants authorize deduction of that fee from Deposit Account 06-0308.

Respectfully submitted,

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